

Claims

What is claimed is:

- 1 1. A keep-warm system for a fuel cell power plant (10),
2 comprising:
 - 3 a. a fuel cell stack assembly (CSA) (12)
4 including an anode (16), a cathode (18), an
5 electrolyte (14), and a cooler (20);
6 b. fuel supply means (25) for providing a supply
7 of fuel, at least some of the fuel being supplied as
8 reactant to the anode (16);
9 c. a source of oxidant reactant (22) operatively
10 supplied to the cathode (18);
11 d. a water management system (30, 28)
12 operatively connected to the cooler (20) of the CSA
13 (12);
14 e. thermal insulating means (64) enclosing at
15 least one of the CSA (12) and the water management
16 system (30, 28) for providing thermal insulation
17 thereof; and
18 f. catalytic fuel burner means (66)
19 operatively connected to the fuel supply means (25)
20 and to the source of oxidant reactant (22) for
21 catalytically reacting the fuel and oxidant and
22 providing a source of heat, the burner means (66)
23 being disposed and operative to supply heated gas into
24 the thermal insulating enclosure means (64), and to the
25 at least one of the CSA (12) and the water management
26 system (30, 28) in the thermal insulating enclosure
27 means (64).
 - 1 2. The keep-warm system of claim 1 wherein the
2 catalytic burner means (66) includes a catalytic
3 surface (72) for combustively reacting the fuel in the

presence of oxidant in a flameless manner to release heat only in a thermal range less than about 1000° F.

1 **3.** The keep-warm system of claim **2** wherein the heat
2 released by catalytic combustion at the catalytic
3 burner means **(66)** is in the thermal range of about
4 200⁰-700⁰ F.

1 **4.** The keep-warm system of claim **2** wherein the source
2 of oxidant reactant (**22**) is ambient air, the air being
3 supplied to the catalytic burner means (**66**) and mixed
4 with fuel from the fuel supply means (**25**) for
5 combustively reacting the mixture in the presence of
6 the catalytic surface (**72**) to release heat.

1 5. The keep-warm system of claim 1 wherein the fuel
2 supply means (25) comprises a container of hydrogen
3 stored under pressure.

1 **6.** The keep-warm system of claim **1** wherein both the CSA
2 **(12)** and the water management system **(28, 30)** are
3 substantially enclosed by the thermal insulating means
4 **(64)**.

1 7. The keep-warm system of claim 4 wherein the
2 electrolyte (14) of the CSA (12) is a proton exchange
3 membrane (PEM), the fuel from the fuel supply means
4 (25) is hydrogen, and the heat released by catalytic
5 combustion at the catalytic burner means (66) is in
6 the thermal range of about 200° - 700° F.

8. In a fuel cell power plant (10) having a fuel cell stack assembly (CSA) (12) including an anode (16), a cathode (18), an electrolyte (14), and a cooler (20), a fuel supply (25) for providing fuel to at least the

5 anode (16), a source of oxidant reactant (22) for
6 supplying at least the cathode (18), and a water
7 management system (30, 28) operatively connected to the
8 cooler (20) of the CSA (12), the method of preventing
9 freezing of water in freeze-sensitive parts of the fuel
10 cell power plant (10) during shutdown, comprising the
11 steps of:

12 a. selectively flowing (62, 63, 69, 67) fuel (25)
13 and oxidant (22) to a catalytic fuel burner (66) during
14 shutdown for catalytic combustion to provide heated
15 gas;

16 b. convectively flowing the heated gas into heat
17 transfer relation with the freeze-sensitive parts of
18 the fuel cell power plant (10) to provide heat thereto;
19 and

20 c. thermally insulating the freeze-sensitive
21 parts of the fuel cell power plant (10) including the
22 heated gas flowing in heat transfer relation therewith.